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engaging surface by a CVD process. In an example, the material deposited on the bone engaging surface is tantalum. One or more other materials, e.g., in addition to tantalum, including alloys thereof, can be used, such as, for example, niobium. The deposited material can lead to improved osseointegration or increased dental bone growth around the dental implant 10.

A method can include inserting a dental implant, including a shaft having a cavity, an exterior surface, and one or more channels including an opening at the exterior surface, and at least one thread, formed of a material different than the shaft and configured to engage and wind around the exterior surface, into a dental bone cavity. The method can include permitting at least a portion of a flowable material to flow through the one or more channels, and into the dental bone cavity, including delivering at least one of a resorbable polymer, a hydrophilic material, an in-growth promotion material, or an antibiotic to the dental body cavity.

In an example, inserting the dental implant can include inserting a pre-loaded amount of the flowable material stored within the cavity. The pre-loaded amount of flowable material can include a pre-measured amount or an amount of flowable material measured by a physician. The amount can depend upon the composition of the flowable material, the jaw bone condition of the patient, medical prognoses of the patient, or the size of the dental implant, among other factors.

In an example, inserting the dental implant can include inserting a porous exterior surface portion, of the shaft, and a non-porous bone-engaging surface, of the at least one thread. As described herein, the at least one thread can receive, through an open end, the shaft of the dental implant.

In an example, permitting the portion of flowable material to flow through the one or more channels can include permitting the portion of flowable material to utilize gravity and flow through a channel oriented at a downward angle, relative to a plane that is orthogonal to a longitudinal axis of the dental implant, between the shaft and the exterior surface. In such an example, the channels can be positioned as described in reference to FIG. 5A.

The method can include hydrating the flowable material after inserting the dental implant into the dental bone cavity. In an example, the flowable material is hydrated by a physician. The flowable material can be hydrated with any suitable fluid. In an example, the flowable material is hydrated by a patient's oral fluid. As described herein, the dental implant can include a hydrophilic material to aid in hydration of the flowable fluid.

In an example, the flowable material can be added during implantation to assist in the placement of the dental implant 10 through lubrication, cooling, or softening of the implantation site. Such a process can be reversed after implantation to help secure the implant 10 within the dental cavity. For example an acid, such as acetic acid, can be injected into the implant or along the thread to initially soften the bone so that implant can be more easily inserted. A pilot drill can be used to create a small hole within the dental bone for the acid to be placed. The acid can remove calcium from the bone leaving behind a collagen matrix, sufficiently pliable for the thread to expand the site for the implant 10 to be inserted. After placement, a flowable material 54 including calcium or buffers to neutralize the acid can be injected into the implant or around the implant. The flowable material can then flow to the implantation site and replenish the calcium in the bone. Such examples can restore the bone to approximately its initial strength, helping lock the implant 10 into the dental cavity site.

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Each of these non-limiting examples can stand on its own, or can be combined in any permutation or combination with any one or more of the other examples.

The above Detailed Description includes references to the accompanying drawings, which form a part of the Detailed Description. The drawings show, by way of illustration, specific embodiments in which the invention can be practiced. These embodiments are also referred to herein as "examples." Such examples can include elements in addition to those shown or described. However, the present inventors also contemplate examples in which only those elements shown or described are provided. Moreover, the present inventors also contemplate examples using any combination or permutation of those elements shown or described (or one or more aspects thereof), either with respect to a particular example (or one or more aspects thereof), or with respect to other examples (or one or more aspects thereof) shown or described herein.

In the event of inconsistent usages between this document and any documents so incorporated by reference, the usage in this document controls.

In this document, the terms "a" or "an" are used, as is common in patent documents, to include one or more than one, independent of any other instances or usages of "at least one" or "one or more." In this document, the term "or" is used to refer to a nonexclusive or, such that "A or B" includes "A but not B," "B but not A," and "A and B," unless otherwise indicated. In this document, the terms "including" and "in which" are used as the plain-English equivalents of the respective terms "comprising" and "wherein." Also, in the following claims, the terms "including" and "comprising" are open-ended, that is, a system, device, article, composition, formulation, or process that includes elements in addition to those listed after such a term in a claim are still deemed to fall within the scope of that claim. Moreover, in the following claims, the terms "first," "second," and "third," etc. are used merely as labels, and are not intended to impose numerical requirements on their objects.

The above Detailed Description is intended to be illustrative, and not restrictive. For example, the above-described examples (or one or more aspects thereof) may be used in combination with each other. Other embodiments can be used, such as by one of ordinary skill in the art upon reviewing the above Detailed Description. Also, in the above Detailed Description, various features may be grouped together to streamline the disclosure. This should not be interpreted as intending that an unclaimed disclosed feature is essential to any claim. Rather, inventive subject matter may lie in less than all features of a particular disclosed embodiment. Thus, the following claims are hereby incorporated into the Detailed Description as examples or embodiments, with each claim standing on its own as a separate embodiment, and it is contemplated that such embodiments can be combined with each other in various combinations or permutations. The scope of the invention should be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled.

The Abstract is provided to comply with 37 C.F.R. §1.72 (b), to allow the reader to quickly ascertain the nature of the technical disclosure. It is submitted with the understanding that it will not be used to interpret or limit the scope or meaning of the claims.

What is claimed is:

1. A dental implant, comprising:

a shaft defining a longitudinal axis and having an apical end, a coronal end, and an exterior surface, a portion of the exterior surface including a porous material;